COMMENSAL RHESUS IN INDIA : THE NEED AND COST OF TRANSLOCATION

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ABSTRACT

Two translocations of commensal rhesus monkey (*Macaca mulatta*) subgroups were undertaken in India as a conservation measure. In August 1989, a total of 21 animals were transported from Tughlaqabad, a site located on the southeastern outskirts of New Delhi, to Meetha Pur, a rural area about 10 km distant. In February 1990, 13 rhesus were taken from Phari Dheeraj, a crowded residential area in Old Delhi, and released at Lal Kuan, a public parkland located near the border of the State of Haryana. On a per-animal basis, the cost of translocating these 34 monkeys was 70 % less than that realized during a previous relocation of Indian rhesus conducted in 1984. The rhesus is not endangered in India, but does occupy a vulnerable position given that (1) its numbers are much reduced relative to what they were 30 years ago, and (2) it is strongly commensal and capable of causing considerable damage to crops and other property. The utility of translocation in the conservation of India's remaining rhesus is discussed in the light of the results of the Tughlaqabad and Phari Dheeraj efforts. It is concluded that, while the cost per animal could be cut further by practicing the relocation of commensal rhesus on a larger scale, the use of translocation on a nation-wide basis will probably remain prohibitively expensive in India, a country with limited financial resources.

Key words : Translocation, rhesus *Macaca mulatta,* commensal, pest, conservation, Inda.

INTRODUCTION

Because of the serious damage they can cause to crops and other property, commensal/pest primates have been harassed, trapped, hunted and even subjected to government-sponsored extermination campaigns in many areas where they

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Rev. Ecol. (Terre Vie), vol. 49, 1994.

occur (Wolfheim, 1983). Today, one of the « notorious » pest species (Else, 1991), the rhesus macaque (*Macaca mulatta*), persists at many localities only because of the forbearance shown by its human neighbors (Southwick *et al.,* 1961 ; Southwick and Siddiqi, 1988). The recent extirpation by villagers in Xinglung, China, of what had been the northernmost, historic natural population of rhesus (Yongzu *et al.,* 1989) underscores this point. The demise of the Xinglung monkeys also demonstrates that, if commensal primates are to be conserved, then management schemes designed to curb their depredations must be devised.

In India, three primate species in particular are strong commensals, namely, the bonnet macaque (*M. radiata*), the Hanuman langur (*Presbytis entellus*) and, of course, the rhesus (Wolfheim, 1983 ; Southwick and Lindburg, 1986). Despite the property damage they can cause, each has benefited from India's tradition of veneration for monkeys ; extermination campaigns are unthinkable in this predominantly Hindu country. Nevertheless, in India as elsewhere the damage caused by primate commensals can outstrip the tolerance of their human neighbors. This will be particularly true in the years to come given that the country's arable land will have to be even more intensively cultivated than it is already to provide for a human population that will double in a mere 35 years and exceed 1 billion in just a decade (Marcot, 1992). Perhaps the species that will be most adversely affected by increasing public disaffection for commensal primates will be the rhesus since most *Macaca mulatta* in India occupy sites located near or even within human communities (Southwick and Siddiqi, 1968).

Concern for the conservation of commensal primates has led to recent attempts by primatologists to develop non-destructive control measures (e.g., Southwick and Siddiqi, 1984 ; Forthman-Quick, 1986 ; Else, 1991). Of those tried thus far, we believe that translocation holds the greatest promise for India's commensal rhesus given that animals removed from problem areas can be used to establish viable groups at other sites and thereby augment overall population numbers (Southwick and Siddiqi, 1984 ; Strum and Southwick, 1986 ; see below). We are cognizant of the reservations others have expressed regarding translocation as a conservation tool, e.g., that translocated animals may disturb the ecology of their new habitat (Conant, 1988) and/or the social community of conspecifics already resident there (Caldecott & Kavanagh, 1983). Undoubtedly, such risks are real. However, in the absence of a rational conservation-minded translocation program, many of those communities experiencing severe monkey-related nuisance problems will likely impose their own « control » measures.

In this paper we describe our own translocation of two rhesus subgroups in India, and consider the implications of our work for the use of this technique on a country-wide basis. In this context we consider both the need for translocation *and* its cost. The capture and relocation of monkeys are labor-intensive when done correctly. The cost per animal transported necessarily reflects this fact and will inevitably limit the extent to which translocation may be practiced in countries such as India coping with a burgeoning human population and limited financial resources. In a pilot study, Southwick *et al.* (1984) demonstrated the utility of translocation in the conservation of India's rhesus. We undertook the Tughlaqabad and Phari Dheeraj translocations to expand on their work, specifically, to explore how inexpensively commensal rhesus can be relocated without putting the animals at undue risk ?

HISTORICAL BACKGROUND

Before discussing our experience with translocation in detail, we need to consider briefly the past and present population status of rhesus in India. The animals are widely distributed, occurring throughout the northern two thirds of the country (Wolfheim, 1983). Informal descriptions of the monkeys' abundance date back to the last century. However, the first systematic field surveys aimed at assessing the population status of India's rhesus were only begun in 1959 by Southwick and co-workers (Southwick *et al.,* 1965). They estimated the total number of rhesus at that time to number around 2 million (Southwick *et al.,* 1965). While this was a relatively large number of animals, the indications were that India's rhesus were then in decline. This was later confirmed by subsequent surveys conducted in the late 1960s and 1970s (Southwick and Siddiqi, 1977 ; Southwick *et al.,* 1983).

The number of rhesus in India had fallen to fewer than 200 000 by 1978, i.e., approximately 90 % since 1959 (Tiwari, 1983 ; Southwick and Siddiqi, 1988). Undoubtedly, the extensive deforestation that India has experienced this century (Marcot, 1992) played a role in the collapse of the country's total rhesus population (Southwick and Siddiqi, 1970, 1983). However, the decline in the number of monkeys was primarily the result of heavy trapping pressure in support of the rhesus export trade. When the trapping of rhesus was at its most intense (i.e., during the 10-year period 1950-1960), India exported 100 000 to 200 000 rhesus monkeys annually (Southwick *et al.,* 1970), primarily to researchers in the United States and Europe. During the 40 years preceding the imposition of an export ban in 1978 by the Government of India, over 2 million animals were shipped (Wolfheim, 1983).

In general, monkeys occupying urban habitats were not taken by exporters because of the animals' greater potential exposure to disease agents such as *Shigella, Salmonella* and *Herpesvirus simiae* (Herpes B) (Southwick and Siddiqi, 1968 ; see also Pucak *et al.,* 1982). Monkey groups in rural areas occupying stands of trees along roadsides and canal banks bore the heaviest trapping losses because of their ready accessibility. However, even among rural groups, trapping losses varied widely from site to site ; for reasons of religious or personal sentiment, villagers at some localities actively intervened on the monkeys' behalf, hindering their capture (Southwick *et al.,* 1980). At those locations where rhesus were denied such protection, where they were harassed and denied access to cultivated fields, many groups were either extirpated or reduced to the point of non-viability.

Rhesus monkeys are still widely distributed in northern India, but their distribution today is markedly patchy. Many roadside and canal bank habitats as well as larger parklands and forest patches once occupied by rhesus now contain few or no monkeys (Southwick and Siddiqi, 1988).

AN EXPLORATORY STUDY

METHODS

In August 1989 a subgroup of 21 monkeys (3 adult males, 6 adult females, 5 infants and 7 juveniles and yearlings) was translocated from Tughlaqabad, a site

located on the southeastern outskirts of New Delhi, to Meetha Pur, a rural area about 10 km distant. Our translocation project was a preemptive measure in that it was inevitable that the translocated animals would be trapped, if not by us then by trappers retained by the Municipal Corporation of Delhi (MCD), the public agency charged with managing the monkey groups residing in and around the capital city.

Indeed, prior to our relocation of the Tughlaqabad animals, the MDC had already removed 100-120 rhesus from this site over the preceding 23 months. The MCD-trapped animals were taken from several different social groups, usually 1-10 individuals at a time, and (we were told) subsequently released singly or in groups of 2-5 animals at a number of locations outside the Delhi metro area. The range of the Tughlaqabad rhesus included areas of human habitation (see Malik, 1989 and Johnson *et al.,* 1991 for detailed descriptions of the site) and the MCD initiated trapping at the site in September 1987 in response to public complaints about the monkeys. Animals of all age-sex classes were removed.

A second translocation of 13 rhesus (2 adult males, 4 adult females, 4 infants and 3 juveniles and yearlings) was undertaken in February 1990. In this case, the animals were taken from Phari Dheeraj, a crowded residential area in Old Delhi, and released at Lal Kuan, a public parkland located southeast of New Delhi near the border of the State of Haryana. As was the case with our first translocation, the animals captured during this second relocation effort were all taken from one social group. The Phari Dheeraj animals, like those taken from Tughlaqabad, had also been the subject of public complaints directed toward the MCD.

The translocated monkeys were trapped in nylon nets with about 1 cm^2 mesh and each was large enough to capture several animals at a time. The nets were put into place and baited both morning and afternoon each day for 1-2 weeks before any animals were captured. This procedure served to habituate the monkeys to the nets and encourage them to return to the area. To insure that the translocated animals all originated from a single social group, we decided that they must all be taken simultaneously. To insure that they would constitute a viable group when released, we further decided that no animals would be netted until and unless a minimum of 12 monkeys were in position to be taken. Of course, we knew nothing about the relatedness of the animals that were eventually captured. However, in order to be trapped together the animals also had to have been feeding together. In macaques, such tolerance is most typically found among kin (Yamada, 1963 ; de Waal, 1991).

The animals which were eventually trapped were transported in the same nets used to capture them. All of the animals were relocated without injury. Because the release sites, Lal Kuan and Meetha Pur, were located relatively near Phari Dheeraj and Tughlaquabad, the translocated animals could be transported and set free within hours of their capture. The monkeys were set free near dusk to discourage them from immediately leaving the area of their release sites. To encourage them to stay in the vicinity over the long term, the translocated animals were provisioned daily for about one month after their release. This procedure proved effective at both Meetha Pur and Lal Kuan just as it did during a previous translocation of rhesus conducted by Southwick *et al.* (1984).

The animals' release sites were chosen only after several other potential locations had been visited. We felt that, as release sites, both Lal Kuan and Meetha Pur had several qualitites to commend them. For example, at both locations there was ample cover and readily available water. Just as important, perhaps, was the fact that, at both sites, the residents of nearby village communities expressed a

willingness to accept the translocated monkeys. This willingness came as a result of repeated consultations with one of us (IM) during which the goals of our translocations were presented in detail (Malik and Johnson, 1991).

At this point, we would like to add that during these discussions the question of what the villagers could do to curb monkey-related nuisance problems and prevent bite wounds was also addressed. The villagers were particularly cautioned against two activities widely practiced in India which almost inevitably precipitate monkey-human conflict, namely, feeding the animals (a practice engaged in by Indians of all ages) and harassing them (an activity mostly engaged in by children and teenagers). We have found that in India the lay person's understanding of the behavior of the rhesus is typically very limited, even among those who live near commensal monkey groups. Hence, although our advice to the Meetha Pur and Lal Kuan villagers may seem to have been rather obvious, it is often the « obvious » precautions that need to be stressed most.

Despite their advantages as release sites, both Lal Kuan and Meetha Pur suffered from the disadvantage of already having resident rhesus groups. It would have been preferable, of course, to release our translocated animals at sites that contained no other monkeys. However, to do so, would have meant transporting our captured animals over much greater distances, adding to their stress and increasing their risk of injury. What is more, the Lal Kuan and Meetha Pur sites both appeared large enough to comfortably accommodate additional animals. We will return to this point later.

RESULTS

Both of our translocations were successful in that the transported animals remained near their release sites and subsequently reproduced well (Malik and Johnson, 1991 ; Malik unpublished data).

TRANSLOCATION COSTS

In table I we have listed both the total cost of our two translocations (in U.S. currency) and the cost per animal transported. We have also broken down our expenditures into three categories : (1) equipment and supplies, (2) transportation and (3) personnel. It is evident from the table that the second of our translocations was much less expensive to implement. The total cost of our second effort was 60 % less than that of the first translocation. However, because fewer animals were transported, the difference between the two was not as great when expressed on a per-animal basis ; the $ 32 spent on each of the Phari Dheeraj monkeys represented only a 35 % savings over the $ 49 spent on each of the Tughlaqabad animals.

Of the two, the Tughlaqabad-Meetha Pur translocation was the least cost effective because of one-time expenditures incurred during its development. For example, more money was spent on equipment for our first translocation because the hand-made nets we purchased and used to trap the Tughlaqabad monkeys were subsequently used again to capture the animals at Phari Dheeraj. Our personnel costs were also higher for our first translocation. Our assistants were not

TABLE I

Breakdown of the cost of our two translocations by category of expenditure.

	First Translocation	Second Translocation	Both
Expenditures			
Equipment and Supplies	$ 722†	$ 246	$ 968
Transportation	11	11	22
Personnel*	*292*	*154*	*446*
Total	$ 1 025	$ 411	$ 1 436
No. animals transported	21	13	34
Cost per animal	$ 49	$ 32	$ 42

† United States currency.
* The participation of the authors was not compensated.

professional trappers and had no previous experience in the capture and handling of monkeys. Hence, to minimize the risk of injury to either themselves or the animals, it was necessary to rehearse them in the mechanics of trapping monkeys prior to the relocation of the Tughlaqabad animals to Meetha Pur. Such training was not necessary prior to the capture of the Phari Dheeraj monkeys.

Both release site, Lal Kuan and Meetha Pur, had a rhesus group in residence before our translocations were undertaken. When surveyed during the summer of 1990, the monkeys released at Lal Kuan were found to be closely associating with those previously occupying this site. Unfortunately, the 1990 census of the Meetha Pur animals revealed that the monkeys translocated from Tughlaqabad had displaced the rhesus group originally occupying this location ; in fact, the latter group was found to have taken up residence just within the outer margin of Meetha Pur village. The displacement of the Meetha Pur rhesus was the most disappointing result of our translocation efforts. However, our experience at Lal Kuan demonstrates that the effect of translocated rhesus troops on resident social groups need not be adverse.

The cost of translocation

The one previous conservation-oriented translocation of rhesus in India was much more costly than our own efforts ; Southwick *et al.* (1984) spent approximately $ 150 on each of the animals they relocated during their pilot study (see Strum and Southwick, 1986). The $ 42 we spent on each of the Tughlaqabad and Phari Dheeraj animals (Table I) represents a savings of over 70 %. The difference in cost was not due to logistics since the animals translocated by Southwick *et al.* (1984) were, like ours, released on the same day they were captured. Rather, the difference reflects our reliance on non-professional trappers and a shorter period of provisioning following the release of the transported animals, i.e., one rather than five months.

One of the obvious lessons of our own work is that the cost effectiveness of translocation will increase as the number of monkeys transported also increases.

The overall cost per animal dropped from $ 49 to $ 42 after the translocation of the Phari Dheeraj animals (Table I), a decline of 14 %. We feel that, if translocation was pursued on a larger scale, one might well be able to cut the cost per monkey to just $ 30 (i.e., almost 40 %) without putting the welfare of the animals at any greater risk.

As indicated earlier, there are probably somewhat more than 500 000 rhesus in India today (Southwick and Siddiqi, 1988). We estimate that at least 10 % of this total (i.e. 50 000 monkeys) are worthy candidates for redistribution through translocation. However, even at $ 30 per monkey, the cost of relocating this many animals ($ 1.5 million) would be prohibitive, especially in a country such as India with limited financial resources. The trappers retained by the Municipal Corporation of Delhi to remove animals from Tughlaqabad were paid the equivalent of about $ 9 per monkey. The MCD's limited funding would not have permitted them to pay much more than this, certainly not as much as $ 30 per animal.

To us, it seems self evident that no governmental body in India, be it on the municipal, state or national level, will ever be able to afford to make the translocation of commensal monkeys a high priority. Indeed, with so many of India's other wildlife species in very eminent danger of extinction (Ward, 1992), the conservation of the rhesus (a species that many in India consider to be a pest) will never receive significant financial support until it too becomes endangered. For now, financial support will necessarily have to come from non-governmental sources. The formation in India of a non-profit institute for primate conservation may be the best mechanism for securing support (from private sources) for translocations and other conservation-related projects focused on non-endangered primates. Giving villagers residing near primate populations an economic incentive to cooperate with and participate in the activities of such an institute would of course be necessary. Tourist income might be a source of financial support for their involvement. (Regrettably, this potential source of revenue has yet to be tapped by any primate conservation project in India.)

Our experience with translocation has convinced us that, except in the case of particularly small groups, the strategy of capturing whole troops of monkeys will always be more time consuming, labor intensive and, therefore, expensive than partial-group transfers. To maximize the cost effectiveness of translocations we believe that the capture and relocation of subgroups is an acceptable strategy. Furthermore, we believe that, under the right circumstances, a partial-group translocation is well suited to the conservation of commensal primate species (see below).

An indication of how expensive whole-group translocations can be is suggested by the relocation of 3 commensal baboon groups in Kenya. Strum (Strum and Southwick, 1986) has reported that the translocation of the Kenyan baboons cost roughly $ 500 per animal. This figure included the expense of 18 months of intensive pre- and post-translocation field study and, therefore, is not wholly comparable to the $ 42 we spent on each of the Phari Dheeraj and Tughlaqabad rhesus we translocated. Nevertheless, it is likely that another reason the baboon translocation was so very much more expensive than our own was that Strum and her co-workers sought to capture and relocate the Kenyan baboon groups in their entirety, 131 individuals in all.

The baboons were translocated because an ever greater proportion of their habitat was being consumed by agriculture, increasingly bringing the animals into conflict with their human neighbors. We do not know whether anything other than

a total-group translocation of the Kenyan baboon troops would have been sufficient to substantially alleviate this conflict. We do know, however, that periodic partial-group transfers would likely serve well as a management strategy for many commensal rhesus groups in rural-agricultural India. Indeed, we believe that partial transfers would be particularly well suited to those locations where the range of commensal rhesus groups is tightly circumscribed, and the monkeys' rate of entry into nearby fields or human settlements is more dependent upon the number of *individuals* occupying a site rather than the number of groups (e.g., the Chhatari site described by Johnson and Southwick, 1984). Translocating only a part of an existing commensal group to a new site would have the dual advantages of reducing the cost of the translocation and increasing the total number of locations occupied by rhesus. The tradition of veneration for monkeys that exists in India would permit the partial rather than total removal of a commensal group since Indian farmers will tolerate the depredations of monkey commensals as long as they are kept at a low level.

We feel it is necessary at this point to emphasize that when we refer to partial-group translocations we are not recommending the translocation of *individual* animals. As Strum and Southwick (1986) have pointed out, the available evidence demonstrates that, among the cercopithecines, translocated individuals usually disperse after release. Furthermore, the social continuity that results from capturing and releasing multiple animals from a single parent group permits each of the affected monkeys to better cope with the trauma of translocation (Strum and Southwick, 1986).

The fact is, we initiated our own translocation efforts in large part because the monkeys taken from Tughlaqabad by the MCD's trappers were reportedly being released singly or in groups of two to five animals, when and where it was convenient for the trappers to let them go. No attempt was being made to determine whether the animals released together actually originated from the same social group. Under these circumstances, we felt sure that any animals relocated by the MCD would probably fare badly in their new surroundings. We felt there was clear need to demonstrate to the MCD authorities the utility of a rational rhesus translocation effort. To insure that our motives not be misunderstood, we undertook the Phari Dheeraj and Tughlaqabad translocations at our own expense, that is, without any external financial support.

The cost of not translocating

Continued growth of commensal rhesus populations in India will inevitably lead to increased crop depredations. In addition, it will also lead to an increase in the frequency and intimacy of monkey-human contacts thereby enhancing the opportunities for the transmission of potential disease agents (e.g. *Shigella, Salmonella* and Herpes B virus) from monkey to human and vice versa (Shah and Southwick, 1965 ; Tiwari and Shukla, 1984). To the best of our knowledge, no disease outbreak within any human community in India has ever been unequivocably linked to monkey-human contact. Nevertheless, the potential for disease transmission is undeniable. As a consequence, we believe that greater commensalism not only threatens the welfare of the monkeys involved, it also constitutes a public health problem.

The screening of over 2 thousand rhesus monkeys captured in the Himalayan foothills of India and imported to the U.S. during the late 1970s, revealed that over

40 % tested positive for at least one potentially harmful pathogen (e.g. *Shigella, Salmonella* and Herpes B) (Pucak *et al.,* 1982). This figure is disturbing given that the animals in question had been forest-dwelling and therefore had had limited exposure to humans. The incidence of potential disease agents among rhesus in rural and urban settings will necessarily be much higher. Indeed, Shah and Southwick (1965) found that 7 of 8 adult animals (87.5 %) taken from rural and urban areas in India tested positive for Herpes B, a pathogen nearly always fatal to humans (Jewett *et al.,* 1992).

Above and beyond the economic and public health problems associated with growing pest populations of *M. mulatta,* there is the real danger that, as the problem of primate pests worsens in India, the traditional veneration of monkeys could be lost. It appears that the 1980s were a period of resurgent good will toward India's monkeys, the product perhaps of greater prosperity and better agricultural fortunes (Southwick and Lindburg, 1986 ; Southwick and Siddiqi, 1988). We fear, however, that this good will could erode rapidly as the growth of the country's human population begins to outstrip recent gains in agricultural productivity. As we see it, the depredations of commensal rhesus could rapidly become to be regarded as intolerable and the monkeys themselves viewed more as vermin than as wildlife. It is entirely possible that public disaffection for rhesus could generalize to some of the other nonhuman primate species in India. In this worst-case scenario, public support for all conservation projects involving monkeys, commensal and non-commensal alike, could suffer.

We conclude by stressing a point previously made by Scott and Carpenter (1987) (also see Konstant and Mittermeier, 1982). Because the factors that lead to successful translocations have still to be determined, there is a need for better documentation of programs involving the capture and release of animals, endangered and non-endangered alike. Inasmuch as many cercopithecines live as rhesus do in matrilineally structured groups, and inasmuch as many of these species are candidates for translocation either because they are either strongly commensal (e.g., the vervets and savanna baboons), or are threatened or endangered (e.g., the Sulawesi macaques), we believe that the record on the rhesus response to live-trapping (of which this report forms a part) has much to offer for the design of management plans focused on other species. We hope that this resource will not be overlooked.

RÉSUMÉ

Cet article décrit deux translocations de sous-groupes de rhésus (*Macaca mulatta*) commensaux en Inde. En août 1989, 21 animaux ont été transportés de Tughlaqabad, aux abords sud-est de New-Dehli, à Meetha Pur, une zone rurale distante de 10 km. En février 1990, 13 rhésus ont été transportés de Phari Dheeraj, une zone résidentielle peuplée du vieux Dehli, à Lal Kuan, un parc public près de la frontière de l'état de Haryana. Le coût de la translocation de ces 34 singes a été réduit de 70 % par rapport aux translocations précédentes conduites en 1984. Le rhésus n'est pas une espèce menacée en Inde mais il est vulnérable, sa population a diminué depuis 30 ans et les comportements de commensalisme et de pillage se répandent. L'utilité de la translocation pour la conservation des rhésus indiens est ici discutée au vu des résultats obtenus à Tughlaqabad et à Phari Dheeraj. Nous en

concluons que malgré une possible réduction des coûts par la translocation à grande échelle, l'utilisation de cette méthode reste d'un coût prohibitif pour l'Inde dont les ressources financières sont limitées.

Mots-clés : Translocation, rhésus *Macaca mulatta,* commensalisme, pillards, conservation, Inde.

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